ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH

Note on the performance in flight of the German jet-propelled aircraft Messerschmitt 262, Heinkel 162 and Arado 234.

by

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and
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SUMMARY

This note describes flight tests on the German jet propelled aircraft Me 262, He 162 and Ar 234 to determine their maximum level speed and rate of climb at various heights. Analysis of the climb and level speed results has enabled the aircraft drag and engine thrusts to be obtained.

1 Introduction

Flight tests were required on the German jet propelled aircraft Me 262, He 162 and Ar 234 to determine their maximum level speeds and rates of climb and to find the aircraft drag and the engine thrusts. The Me 262 is a high speed twin-engined fighter, the He 162 a single-engined fighter with the engine in an unusual position on the top of the fuselage, and the Ar 234 a high wing twin-engined single-scater bomber with bombs carried externally under the fuselage and nacelles. The aircraft tested were in operational condition except that there was no ammunition in the fighters and no bombs on the bomber. Relevant details are given in table I.

2 Description of tests

The Me 262 and Ar 234 were fitted with Jumo 004B axial flow jet propulsion units of 2000 lb. main propulsion thrust. These engines have variable exit nozzles controlled hydraulically. The exit area is normally at its largest except above 8000 r.p.m (8700 is the maximum) or above 300 m.p.h. above S.I. forward speed when a servo unit moves the exit nozzle bullet to reduce the exit area. To enable thrust and drag to be determined from climb and level speeds the forward speed servo control was disconnected so that there was no change in jet exit area from climbing speed to top level speed. To find the maximum level speed of the aircraft this servo control was reconnected.

The He 162 was fitted with a BMW 003 axial-flow jet propulsion unit reputed to have 1760 lb. static thrust. Here again the jet pipe exit area can be varied by a sliding bullet but the three positions of the nozzle can be selected by the pilot. These positions are referred to as "H" for high altitude use (the largest exit area) "S" the standard...
position for normal use and "F" for high speed flight (the smallest exit area). Top level speeds were obtained with all three nozzle positions; climb was made in "S" position and thrust and drag analysis made on the climbs and levels in "S" nozzle position.

All tests were made at maximum engine R.P.M., 8700 R.P.M. for the Jumo 04L and 9500 for the B.M.W. 003. Where these R.P.M.'s could not be obtained exactly due to engine automatic controls the results were corrected to the above standard R.P.M.'s.

3 Results

The results obtained were corrected by the temperature height method given in ref. 1. The advantage of this method is that few assumptions need to be made about the engine characteristics which in this case were practically unknown. The top speeds and maximum rates of climb are shown for the three aircraft in figs. 1, 2 and 3. The performances of Me 262 and Ar 234 agree well with the German figures obtained to date. The He 162 falls short of the 450 m.p.h. ground level and 222 m.p.h. at 20,000 ft quoted by the German sources of information, but this is mostly due to the poor thrust of the engine.

Analysis of the results have shown the aircraft profile drags at a Reynolds number of approximately 20 million to be 66 lb. for the Me 262, 74 lb. for the He 162 and 75.5 lb. for the Ar. 234, all quoted at 100 ft/sec. The estimated values were 66.3, 53.7 and 76.2 lb. respectively. A drag analysis is given in Table II.

The thrusts of the Jumo 04L and B.M.W. 003 recorded in flight are shown in fig. 4 as a function of altitude, corrected to I.C.A.N. conditions. The thrust variation of the Jumo 04L with altitude appears to be proportional to air pressure/air temperature) where n = 2 at top speed and n = 1.4 in the climb at 290 m.p.h. mean true speed. These variations are quite usual. On the B.M.W. 003, the variation is of the same form with n = 4 at top level speed. This value is unusually high.

Considerable interest has been shown in the difference between the top speeds of Me 262 and Meteor III. The difference is due to the higher profile drag of the Meteor caused by its higher wing drag, associated with its lower wing loading. This can be seen from Table 2 where a Meteor drag analysis is included for comparison with Me 262. For this reason the Meteor would be roughly 20 m.p.h. slower than the Me 262 fitted with engines of the same thrust. The advantages of the lower wing loading lies in the reduced take-off distance and increased manoeuvrability.

4 Conclusions

The performances of Me 262 and Ar 234 agree with the estimated values and those given by German sources. The He 162 performance is less than predicted, due mainly to low engine thrust.

The engine thrust and variation of thrust with height on the Jumo 04L are as expected. The thrust of the B.M.W. 003 is low at ground level but it does not fall off with altitude as rapidly as that of the Jumo 04L. The profile drags of the aircraft obtained from analysis of the flight tests have shown substantial agreement with the estimated values,
References:

<table>
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<th>No.</th>
<th>Author</th>
<th>Title etc.</th>
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Attached:

Drg. Nos. 17820S-17823 S
Table I - Table II

Distribution:

De S.R.
De D.S.R.E.
De D.B.T.
De D/R.D.T.1
S.R.1
R.T.F. (T.I.B.)
D.D./R.D.A.
D.T.D.
D.B.T.E.
D.E.D.
A & A.E.E.
A.I. 2g
R.D.T.3
Foreign Aircraft Dept. 5
Director
De D.R.E.
De D.A.P.
Library
S.M.E.
Aero (1)
Aero T/A
Aero P
Aero F
Aero F/J 4
File No. 1621 B
### Table I
#### Aircraft Data

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<thead>
<tr>
<th></th>
<th>He 262</th>
<th>He 162</th>
<th>Ar 234</th>
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<tbody>
<tr>
<td>Wing Area</td>
<td>226 sq.ft.</td>
<td>120 sq.ft.</td>
<td>296 sq.ft.</td>
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<td>Aspect Ratio</td>
<td>7.5</td>
<td>4.65</td>
<td>5.8</td>
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<tr>
<td>All up weight of aircraft</td>
<td>14,730 lbs*</td>
<td>5920 lbs*</td>
<td>17,770 lbs+</td>
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<td>Weight with tanks empty</td>
<td>11,120 lbs</td>
<td>4,610 lbs</td>
<td>11,110 lbs</td>
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<tr>
<td>Wing Loading at take-off</td>
<td>65</td>
<td>49</td>
<td>60</td>
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* Without ammunition

+ Without bombs

### Table II
#### Analysis of Aircraft Drag

<table>
<thead>
<tr>
<th>Aircraft Component</th>
<th>Meteor III</th>
<th>He 262</th>
<th>He 162</th>
<th>Ar 234</th>
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<tbody>
<tr>
<td>Wings</td>
<td>26.0</td>
<td>26.3</td>
<td>8.7</td>
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<td>Tailplane</td>
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<td>Fuselage</td>
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<td>10.4</td>
<td>6.0</td>
<td>11.4</td>
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<td>Nacelles</td>
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<td>Cabin</td>
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<td>1.5</td>
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<td>Guns</td>
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<td>3.0</td>
<td>2.0</td>
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<td>Pitot</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Miscellaneous (Interference etc.)</td>
<td>3.0</td>
<td>8.0</td>
<td>7.0</td>
<td>10.5</td>
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</tbody>
</table>

| Total                  | 72.0 lbs at 100 ft/sec. | 66.3 lbs at 100 ft/sec. | 33.7 lbs at 100 ft/sec. | 78.2 lbs at 100 ft/sec. |
PERFORMANCE OF MESSERSCHMITT 262.

AVIA 6/1970

Fig. 1

Forward speed servo control disconnected.
PERFORMANCE OF HEINKEL 162.
PERFORMANCE OF ARADO 234.
JUMO 004 B.I.

AVIA 6/19201

ENGINE NETT THRUST - HEIGHT.

B.M.W. 003.